COURSE TITLE: ENTREPRENEURSHIP IN MICROBIOLOGY

Course Code: 24MICEPSC3

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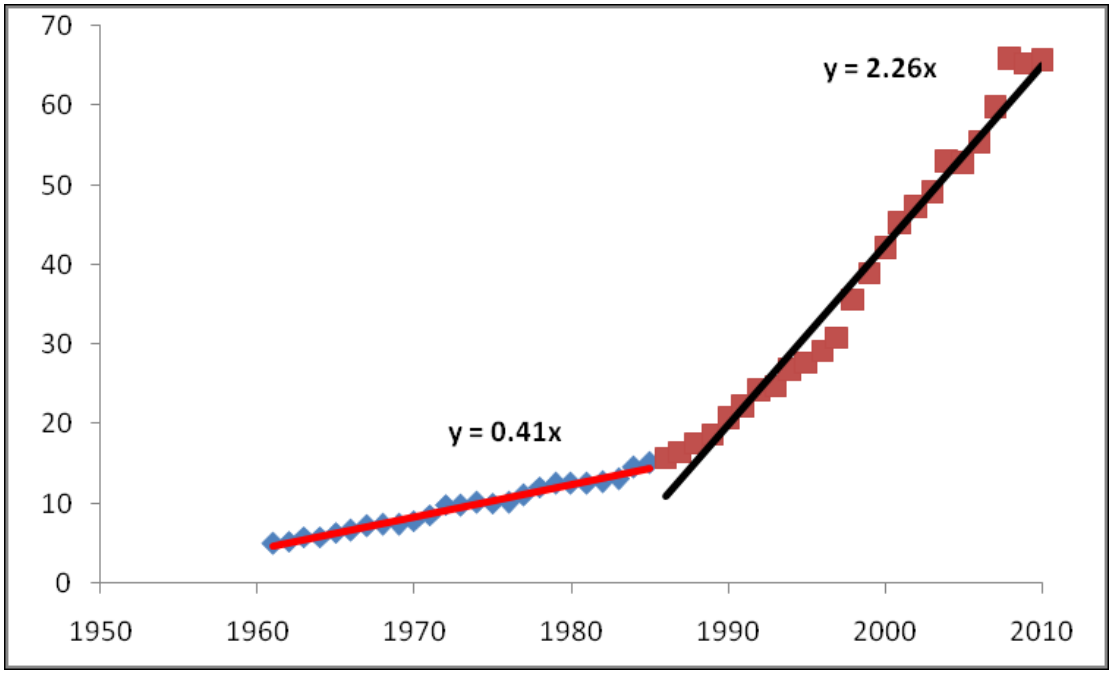
Technologies for Mushroom Production

What is mushroom?

Enlarged complex aboveground fleshy fruiting body of a fungus (such as a basidiomycete) that consists typically of a stem bearing a pileus.

Botanical Name	Common Name
Pleurotus sp.	Oyster mushroom
Volvariella sp.	Paddy straw mushroom
Agaricus sp.	Button mushroom
Calocybe sp.	Milky mushroom

World Mushroom Production (FAO Stat) (in lakh tons)



INTRODUCTION

- **Residues from crops** after harvest can be recycled in agriculture **not only to conserve energy but also to minimize pollution**.
- Intensive agriculture in the last three decades has no doubt increased food production but the disposal of plant residues has posed new problems.
- Some of the important residues are **straw from rye, wheat, barley, rice oat, trash from sugarcane, husk from paddy,** etc.
- A mushroom grower is required to **have adequate information about the production technology and also information about the economics** of mushroom cultivation.

- Depending on the availability of work force, raw materials, infrastructure and market, planning for a small, medium and large unit may be chalked out, yet it is crucial to determine the optimum output level which makes a farm viable.
- The economics of mushroom cultivation differ across regions, and also have a bearing on the benefit-cost ratio.
- Now-a-days, the attention of the government is also focused on wealth from wastes.
- The cultivation of edible mushroom is possible from agrowastes containing cellulose.
- Since, mushroom possess cellulolytic property, they can be grown on cellulosic substrates like paddy straw, sugarcane trash, paddy husk etc.
- Mushroom cultivation involves a number of different operations including preparation of pure culture, spawn and compost as well as crop management and marketing.

EDIBLE MUSHROOM

- There are more than 20 edible mushroom var. are present at this time. White Button, Oyster, Milky, Paddy straw, Shitake and some other mushroom are very popular among consumer but 80 per cent of Indian market is covered by White button mushroom (*Agaricus bisporus)* only .

POISONOUS MUSHROOM

Mushroom that contain toxic substances, which resulting poisoning by the ingestion.

Requirements of mushroom cultivation

- For cost estimating, the average expenditure on various inputs like straw, spawn, insecticides, casing soil, labour and other miscellaneous materials was taken.
- This cost along with the interest on working capital (@ 10 % per annum) formed the total variable cost.

Cost of cultivation: $$Total\ Cost = depriciation\ on\ total\ fixed\ cost + total\ variable\ cost$$

Fixed cost: Fixed cost include cost incurred on equipment, shed and overhead charges including interests on fixed capital & depreciation, maintenance etc.

Variable cost: Variable costs include spawn, substrate, labor, chemicals, casing, polythene sheets, transport charges, electricity rate, market charges etc.

Profitability: To check the profitability in mushroom production the following efficiency measures are use in the study.

Benefit-cost ratio:

$$Benefit\ Cost\ Ratio = \frac{Gross\ income}{total\ cost}$$

Break-even production & price:

$$Production = \frac{Total\ cost}{price/unit}, \quad Price = \frac{Total\ cost}{production}$$

Return from Oyster mushroom production

S. No.	Particulars	Price (Rs.)
1	Cost of production	11850
2	Gross income	17400
3	Net income	5550
4	Benefit-Cost ratio	1.47:1

Return from Button mushroom production

S.No.	Particulars	Price (Rs.)
i)	Cost of production	59550
ii)	Gross income	70335
iii)	Net income	10785
iv)	Benefit-Cost ratio	1.18:1

Constraints of mushroom production

i. Lack of spawn units in locality

ii. Lack of compost unit in State

iii. Lack of proper markets

iv. Low input application

v. High transportation charges

vi. Lack of storage facility

Cultivation of edible mushroom

Mother spawn preparation

The 1st generation of fungal culture is called 'mother spawn'.
The mother spawn can be successfully used upto 3rd or 4th generation continuously to prepare ordinary spawn for mushroom cultivation.
The cholam (*Sorghum*) grains (small size) (1 kg) are placed in a trough of water to remove the chaffy grains.
Then it is half cooked (approximately 20 min.).
The excess water is drained and spread on sterilized cloth.
Then 20g of $CaCO_3$ coating prevents the grain from sticking.
These grains are filled in clean glucose drip bottles (300g / bottle) or polythene bag.
Then the bottles are tightly plugged with non-absorbing cotton, wrapped and boiled for 30 min.
After cooling, the bottles are ready for inoculation

Inoculation technique for spawn

- The sterilized grains containing bottles are taken into the culture room.
- The inoculation work can be done in the Laminar flow Chamber.
- With the help of cork-borer 10 mm diameter disc made from the Petri plates having fully grown mushroom fungus.
- The discs are transferred into the sterilized spawn bottle with the help of an inoculation needle.
- The bottles are incubated at room temperature.
- The white mycelium is observed in the entire bottle after 12 days of inoculation. This is known as “mother spawn”.

Multiplication of spawn from mother spawn

- From a **single mother spawn bottle at least 25 spawn bottles can be prepared**.
- The $CaCO_3$ mixed grains are sterilized, and then the bottles are inoculated with mother spawn.
- About **10 g of cholam grains along with the mushroom** fungus is required for inoculation.
- The inoculated bottles is plugged with the non-absorbent cotton immediately & wrapped with paper and tied with a thread.
- The spawn bottle is **incubated for 15 days** for spawn run.
- One can use this spawn **upto a period of 30 days** from the date of inoculation.

Preparation of mushroom bed & cultivation of mushrooms

- Mushroom beds can be prepared using different substrates *viz*., **paddy straw, sugarcane trash & paddy husk**.
- For **each spawn bottle two beds can be prepared. Size of each bed is 30 × 60 cm.**
- Fresh paddy straw are chopped into pieces of 2-3 inches length & soaked in water for 10 h.
- Water is then drained off from the paddy straw.
- Afterwards, the paddy straw was sterilized using vertical autoclave at 15 lbs pressure for 20 min.
- The sterilized paddy straw was placed on a wire mesh net for draining excess water.
- Polythene covers in the size of 30 × 60 cm are procured and filled with the treated paddy straw as follows.

Mushroom bed preparation Contd…

- Before preparing mushroom beds, hands and all the instruments should be sterilized with diluted solution of **KMnO4/ alcohol**.
- A polythene bag is tied at one end and sterilized paddy straw was filled through the open end for about 5 cm in length.
- A handful of spawn from the bottle is spread (15 g) towards the periphery of this layer.
- Over the spawn some more paddy straw are put and pressed lightly. This process is repeated five times.
- The mouth of the bag is rolled and closed with stapler pins.
- Holes are made over the bag for aeration.
- One bottle of spawn is enough to inoculate two bags of paddy straw.
- Inoculated paddy straw bags are kept in a in a ventilated dark chamber.

Mushroom bed preparation Contd…

- The mycelia will colonize the entire paddy straw bag within 15 days.
- Now the polythene cover was peeled off and the compact lump of paddy straw is placed in a cool shady room and sprayed with 3-4 times per day.
- The young fruit bodies will come out from the bag.
- When the bodies attain their full growth, they will be harvested

Flow chart - P reparation of mushroom bed

Paddy straw substrates 2-3 inch length

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Soak in clean water for 9 h

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Decant the water and sterilize the paddy straw

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Place the sterilize straw in a clean paper under fan (20 min.)

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Make the polythene bag (60 × 30 cm) into a cylinder like size

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Fill up the bag upto 5 cm height with sterilized paddy straw

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Spread the spawn (5g) over the paddy straw

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Again fill up paddy straw substrates upto 5cm height

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Do it five times and tie the bag with the help of thread

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Make small holes on the mushroom bed (for aeration)

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Remove the polythene cover and sprinkle water 2 times daily

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Young fruit bodies will develop

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Harvest the fruit bodies within 3 days after attaining maturity

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Keep the fruit body in a refrigerator for 48 h.

Mushroom Recipes

- Mushroom soup
- Mushroom vegetable curry/ peas curry
- Mushroom fry
- Mushroom pickle
- Mushroom cutlet
- Mushroom kuruma
- Mushroom briyani
- Creamy mushroom
- Marinated mushroom salad
- Mushroom snacks
- Mushroom pakodes
- Mushroom omlette
- Mushroom sandwiches
- Mushroom biscuits
- Mushroom pupetts
- Mushroom pulavu
- Mushroom baji
- Mushroom masala
- Mushroom pannier
- Mushroom chappathi
- Mushroom gheer
- Mushroom ketchup

Preparation of coirpith compost using mushroom spawn

Spread coir pith uniformly under shaded place (100 kg) (5 × 3m)

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Spread the spawn over the surface of first layer of coir pith (1 bottle)

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Spread coir pith uniformly over the first layer (100 kg)

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Distribute 1 kg of urea over the second layer

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Repeat the same process upto one meter height with 10 layers of coir pith

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Maintain the moisture content upto 200 %

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Allow the heap to decompose for a period of one month

Uses of composting

- Lignin content is reduced from 3.0 % to 4.8 %.
- C: N ratio is narrowed down from 112:1 to 24.1.
- Nitrogen content is increased from 0.26 % to 1.06 %.
- The compost contains rich amount of micro, macro and secondary nutrients.
- This compost is beneficial to dry and alkali soils.
- It improves the water holding capacity and physical character of soils.